

WE CLAIM:

1. A device for insertion into a body of a subject being treated, the device delivering localized x-ray radiation, comprising:

a shaft, including a proximal and a distal portion;

a vacuum housing coupled to the distal portion of the shaft;

an anode disposed within the vacuum housing; and  
a cathode structure disposed within the vacuum housing, the cathode structure including a thin diamond film, the thin diamond film being operative with the anode to produce the localized x-ray radiation.

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2. The device of claim 1 further comprising a voltage source coupled to the proximal portion of the shaft and operative with the anode and cathode structure to produce the localized x-ray radiation.

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3. The device of claim 1 further comprising a getter disposed within the vacuum housing.

4. The device of claim 1 wherein the cathode structure further comprises a getter on which the thin diamond film is disposed.

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5. The device of claim 4 wherein the getter is sufficiently conductive to facilitate the application of an electric potential to the thin diamond film.

5           6. The device of claim 4 wherein the getter is comprised of approximately 70% zirconium, 24.6% vanadium, and 5.4% iron.

7. The device of claim 1 wherein the vacuum  
10 housing further comprises an insulator.

8. The device of claim 1 wherein the anode is comprised of tungsten.

15           9. The device of claim 1 wherein the cathode structure is comprised of a molybdenum base on which the thin diamond film is disposed.

10           10. The device of claim 1 wherein the cathode structure is comprised of a silicon base on which the thin diamond film is disposed.

11. The device of claim 1 wherein the cathode structure is comprised of a tantalum base on which the thin  
25 diamond film is disposed.

12. The device of claim 1 wherein an outer diameter of the integrated device is less than or equal to approximately two and one-half millimeter.

13. The device of claim 12 wherein an outer diameter of the integrated device is less than or equal to one and one-quarter millimeter.

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14. The device of claim 1 further comprising a coaxial conductor having a proximal and distal portion, the coaxial conductor coupled to the anode and the cathode, the coaxial conductor disposed within the shaft and coupled to,  
10 the voltage source.

15. The device of claim 1 wherein the shaft is a catheter and the vacuum housing is disposed within the catheter.

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16. A device for insertion into a body of a subject being treated, the device delivering localized x-ray radiation, comprising:

a vacuum housing;  
20 an anode, disposed within the vacuum housing; and  
a cathode structure disposed within the vacuum housing, including a thin diamond film disposed on a getter, the thin diamond film being operative with the anode to produce the localized x-ray radiation.

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17. The device of claim 16 further comprising a voltage source operative with the anode and thin diamond film to generate localized radiation.

18. The device of claim 16 wherein the getter is sufficiently conductive to facilitate the application of an electric potential to the thin diamond film.

5           19. The device of claim 16 wherein the getter is comprised of approximately 70% zirconium, 24.6% vanadium, and 5.4% iron.

10           20. The device of claim 16 wherein the anode is, comprised of tungsten.

15           21. The device of claim 16 further comprising a shaft including a proximal and a distal portion, the vacuum housing coupled to the distal portion.

            22. The device of claim 21 wherein the shaft is a catheter and the vacuum housing is disposed within the catheter.

20           23. The device of claim 16 wherein an outer diameter of the integrated device is less than or equal to approximately one and one-quarter millimeter.

25           24. The device of claim 16 wherein the vacuum housing further comprises an insulator.

25. A device for insertion into a body of a subject being treated, the device delivering localized x-ray radiation, comprising:

an anode;

5 a cathode structure operative with the anode to produce localized x-ray radiation; and

a vacuum housing enclosing the anode and the cathode structure, an outer diameter of the housing being less than or equal to approximately one and one-quarter  
10 millimeter.

26. A method for fabricating a device for producing localized x-ray radiation, the device being capable of insertion into a body of a subject being  
15 treated, the method comprising the steps of:

providing a getter having a tip portion corresponding to a cathode structure where the getter has an activation temperature;

forming a thin diamond film on the tip portion of  
20 the getter at a temperature less than the activation temperature to provide a thin diamond film cathode;

disposing the cathode within a vacuum housing;  
and

increasing the temperature to the activation  
25 temperature to activate the getter.

27. The method of claim 26, further comprising the step of providing a voltage source, the voltage source operative with the cathode structure to generate the localized x-ray radiation.

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28. The method of claim 26, wherein the getter is shaped into a cone shape.

29. The method of claim 26, wherein the getter  
10 is shaped into a cone shape with a rounded apex.

30. The method of claim 26, wherein the thin diamond film is formed using a laser ion source.